[0309] CLAIMS

What is claimed is:

1. A method comprising:

measuring the error rate at a Physical Layer in a protocol stack for an application in communication over a third generation (3G) wireless network between a server and a wireless client;

estimating throughput, as a function of the measured error rate, in the 3G network between the server and the wireless client;

reporting the measured error rate and the estimated throughput to an Application Layer in the protocol stack;

receiving a request for service from the wireless client at the server; and

transmitting the requested service, at the estimated throughput, from the server to the wireless client through the 3G wireless network.

2. The method as defined in Claim 1, wherein transmitting the requested service comprises:

allocating the requested service between a plurality of called base layers (BLs) and a plurality of called enhancement layers (ELs); and

if data of one called BL or of one called EL is sent from the server but not received at the wireless client or is received at the wireless client and is in error;

then performing an error correction procedure, wherein the error correction procedure that is performed for the data of the one called BL is different than the error correction procedure that is performed for the data of the one called EL.

3. The method as defined in Claim 2, wherein:

the error correction procedure that is performed for the data of the one called BL includes:

an automatic retransmission request (ARQ) from the wireless client to the server; and

a forward error correction (FEC) transmission from the server to the wireless client;

the error correction procedure that is performed for the data of the one called EL includes:

a forward error correction (FEC) transmission from the server to the wireless client.

4. The method as defined in Claim 2, wherein the error correction procedure that is performed for the data of the one called BL comprises:

when the wireless client determines that a delay bound for the data of the one called BL is unexpired and that a retransmission request limit for the data of the one called BL is unexceeded, then the wireless client sends a retransmission request to the server identifying a lost or an error portion of the data of the one called BL, and upon receipt of the retransmission request in the server from the wireless client, the server sends to the wireless client a forward error correction (FEC) transmission including the lost one called BL or the error portion of the data of one called BL that is less that all of the data in the one called BL.

5. The method as defined in Claim 4, wherein the retransmission request limit for the data of the one called BL ($N_{\max}$) is a function of:

the delay bound ($D_{constrained}$) for the data of the one called BL, which is limited by a video frame rate for video data of the data of the one called BL;

the current roundtrip transmission time (*RTT*) for transmissions between the wireless client and the server; and

an estimate of the time consumed to process the data of the one called BL ($D_{processing}$).

6. The method as defined in Claim 5, wherein $N_{\max} = \frac{D_{constrained} - D_{processing}}{RTT}$.

7. A computer-readable medium having computer-executable instructions that, when executed by a computer, performs the method as recited in Claim 1.

8. A computer comprising one or more computer-readable media having computer-executable instructions that, when executed by the computer, perform the method as recited in Claim 1.

9. A method comprising:

measuring performance information at a Physical Layer in a protocol stack that includes a Data Link Layer, a Transport Layer, and an Application Layer, the protocol stack providing a communication protocol between a server and a wireless client in a 3G wireless network, the performance information including:

the physical-channel bit error rate (BER);

the transport-channel block error rate (BLER); and

the transport-channel bit rate;

estimating from the measured performance information:

a UDP throughput between the Transport Layer and the RLC sublayer of the Data Link Layer; and

the average transport-channel block error rate P_{BL};

reporting to the Application Layer, after a user-defined time interval, the measured performance information, the UDP throughput, and the average transport-channel block error rate P_{BL};

receiving at the server a request for service from the wireless client; and

transmitting from the server to the wireless client the requested service at the estimated UDP throughput based upon the average transport-channel block error rate P_{BL}.

10. The method as defined in Claim 9, wherein transmitting from the server to the wireless client the requested service comprises:

allocating the requested service in a plurality of called BL packets for a plurality of base layers (BLs) and in a plurality of called EL packets for a plurality of enhancement layers (ELs); and

performing an error correction procedure when one called BL packet or one called EL packet is unreceived at the wireless client or is received at the wireless client and is in error, wherein the error correction procedure that is performed for one called BL packet is different than the error correction procedure that is performed for one called EL packet.

11. The method as defined in Claim 10, wherein:

the error correction procedure that is performed for the one called BL packet includes:

an automatic retransmission request (ARQ) from the wireless client to the server; and

a forward error correction (FEC) transmission from the server to the wireless client;

the error correction procedure that is performed for one called EL packet includes:

a forward error correction (FEC) transmission from the server to the wireless client.

12. The method as defined in Claim 10, wherein the error correction procedure that is performed for the one called BL packet comprises:

if the wireless client determines that a delay bound for the one called BL packet is unexpired and that a retransmission request limit for the one called BL packet is unexceeded;

then the wireless client sends a retransmission request to the server identifying a lost or an error portion of the one called BL packet; and

upon receipt of the retransmission request by the server from the wireless client, then the server sends to the wireless client a forward error correction (FEC) transmission including the lost packet or the error portion of the one called BL packet that is less that all of the one called BL packet.

13. The method as defined in Claim 12, wherein the retransmission request limit ($N_{\max}$) for the one called BL packet is a function of:

the delay bound ($D_{constrained}$) for the one called BL packet, wherein $D_{constrained}$ is limited by a video frame rate for video data of the one called BL packet;

the current roundtrip transmission time (*RTT*) for one packet between the wireless client and the server; and

an estimate of the time consumed to process the one called BL ($D_{processing}$).

14. The method as defined in Claim 13, wherein $N_{\max} = \frac{D_{constrained} - D_{processing}}{RTT}$.

15. A computer-readable medium having computer-executable instructions that, when executed by a computer, performs the method as recited in Claim 9.

16. A computer comprising one or more computer-readable media having computer-executable instructions that, when executed by the computer, perform the method as recited in Claim 9.

17. A method comprising:

receiving at a server a request for service over a 3G wireless network from a wireless client;

allocating the requested service in a plurality of called BL packets for a plurality of base layers (BLs) and in a plurality of called EL packets for a plurality of enhancement layers (ELs);

transmitting from the server to the wireless client the requested service in the plurality of BL and EL packets;

performing an error correction procedure when one called BL packet or one called EL packet is unreceived at the wireless client or is received at the wireless client and is in error, wherein:

the error correction procedure that is performed for the one called BL packet includes:

an automatic retransmission request (ARQ) from the wireless client to the server; and

a forward error correction (FEC) transmission from the server to the wireless client;

the error correction procedure that is performed for one called EL packet includes:

a forward error correction (FEC) transmission from the wireless server to the wireless client.

18. The method as defined in Claim 17, wherein the error correction procedure that is performed for the one called BL packet comprises:

if the wireless client determines that a delay bound for the one called BL packet is unexpired and that a retransmission request limit for the one called BL packet is unexceeded;

then the wireless client sends a retransmission request to the server identifying a lost or an error portion of the one called BL packet; and

upon receipt of the retransmission request by the server from the wireless client, then the server sends to the wireless client a forward error correction (FEC) transmission including the lost packet or the error portion of the one called BL packet that is less that all of the one called BL packet.

19. The method as defined in Claim 18, wherein the retransmission request limit ($N_{\max}$) for the one called BL packet is a function of:

the delay bound ($D_{constrained}$) for the one called BL packet, wherein $D_{constrained}$ is limited by a video frame rate for video data of the one called BL packet; and

the current roundtrip transmission time (*RTT*) for one packet between the wireless client and the server; and

an estimate of the time consumed to process the one called BL ($D_{processing}$).

20. The method as defined in Claim 19, wherein $N_{\max} = \frac{D_{constrained} - D_{processing}}{RTT}$.

21. A computer-readable medium having computer-executable instructions that, when executed by a computer, performs the method as recited in Claim 17.

22. A computer comprising one or more computer-readable media having computer-executable instructions that, when executed by the computer, perform the method as recited in Claim 17.

23. A network server comprising:

a system memory to store a content delivery media streaming application;

a device to communicate with a 3G wireless network;

a control logic, in communication with the system memory and the device, to:

invoke an instance of the content delivery media streaming application, in response to a request for service from a wireless client through the 3G wireless network;

estimate throughput in the 3G network with the wireless client;

measure an error rate at a Physical Layer in a protocol stack that includes an Application Layer;

report the measured error rate and the estimated throughput to the Application Layer; and

provide the requested media content to the wireless client through the 3G wireless network at the estimated throughput.

24. The network server defined in Claim 23, wherein:

the content delivery media streaming application provides the requested media content to the wireless client by an allocation of the requested media content between both called base layers (BLs) and called enhancement layers (ELs); and

if:

data of one called BL is sent from the network server but not received at the wireless client or is received at the wireless client and is in error;

a delay bound for the data of the one called BL is unexpired; and

a retransmission request limit for the data of the one called BL is unexceeded;

then the request for media content from the wireless client is a retransmission request identifying a lost or an error portion of the data of the one called BL, and upon receipt of the retransmission request by the server from the wireless client, the server sends to the wireless client a forward error correction (FEC) transmission including the lost one called BL or the error portion of the data of one called BL that is less that all of the data in the one called BL.

25. The network server as defined in Claim 24, wherein the retransmission request limit for the data of the one called BL ($N_{\max}$) is a function of:

the delay bound ($D_{constrained}$) for the data of the one called BL, which is limited by a video frame rate for video data of the data of the one called BL;

the current roundtrip transmission time (*RTT*) for transmissions between the wireless client and the server; and

an estimate of the time consumed to process the data of the one called BL ($D_{processing}$).

26. The network server as defined in Claim 25, wherein

$$N_{\max} = \frac{D_{constrained} - D_{processing}}{RTT}.$$

27. A method comprising:

deriving at a server from a prior communication with a wireless client from a communication link in a 3G wireless network:

a Bit Error Rate (BER);

a Forward Error Correction (FEC); and

a channel delay metric;

estimating a channel status between the wireless client and the server as a function of the BER, the FEC, and the channel delay metric;

receiving at the server a request for service from the wireless client;

allocating, at a bit rate derived from the estimated channel status, bits for the requested service between a plurality of base layers (BLs) and a plurality of enhancement layers (ELs), depending upon the media type designated in the request for service from the wireless client; and

adjusting the quality of service level in supplying the service requested by the client as a function of the allocation of the bits for the requested service.

28. The method as defined in Claim 27, wherein:

the server and the wireless client communicate through a transport protocol that includes a Physical Layer, a Data Link Layer, a Network Layer, a Transport Layer, and an Application Layer;

the bits of the requested service are allocated at the Application Layer; and adjusting the quality of service level further comprises:

adaptively spreading the requested service, as a function of various data rates for different media in the requested service, among a plurality of transport channels in an air interface with the Physical Layer;

adaptively selecting, as a function of a selected latency and fault tolerance for different media in the requested service, a transport channel coding model for each said transport channel in the Physical Layer;

adaptively selecting, as a function of a selected latency and fault tolerance for different media in the requested service, an interleaving length in the Physical Layer;

adaptively scheduling packets, as a function of a selected latency and fault tolerance for different media in the requested service, for each said BL and each said EL between multiple media streams in the Medium Access Control (MAC) sublayer of the Data Link Layer;

adaptively determining, as a function of the selected latency for different media in the requested service, a retransmission-count in the Radio Link Control (RLC) sublayer of the Data Link Layer; and

adaptively selecting a transport protocol in the Transport Layer for different media streams as a function of different media in the requested service from the wireless client.

29. The method as defined in Claim 28, wherein adaptively selecting the transport protocol comprises:

selecting the TCP protocol for the delivery of Web data and file data requested in the requested service from the wireless client; and

selecting the UDP protocol for the delivery of other data requested in the requested service from the client;

30. The method as defined in Claim 28, wherein allocating bits for the requested service comprises:

adaptively allocating, as a function of the estimated channel status, bits for the requested service for a source bit stream and for Forward Error Correction (FEC) coding in the Application Layer.

31. A computer-readable medium having computer-executable instructions that, when executed by a computer, performs the method as recited in Claim 27.

32. A computer comprising one or more computer-readable media having computer-executable instructions that, when executed by the computer, perform the method as recited in Claim 27.